PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G05D 13/62 — A1

(11) International Publication Number: WO 95/27237

(43) International Publication Date: 12 October 1995 (12.10.95)

(21) International Application Number: PCT/KR94/00112

(22) International Filing Date: 18 August 1994 (18.08.94)

(30) Priority Data:
1994/6909 1 April 1994 (01.04.94) KR

(71) Applicant *(for all designated States except US)*: ASIA MOTORS CO., INC. [KR/KR]; 15, Youido-dong, Yongdungpo-ku, Seoul (KR).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: JU, Sung, Ho [KR/KR]; Hyundai Apartment 101-1406, 36-1, Yonje-dong, Puk-ku, Kwangju-shi (KR).

(74) Agent: SUH, Man, Kyu; 3rd floor, Jung-An Building, 827-64, Yoksam-dong, Kangnam-ku, Seoul 135-080 (KR).

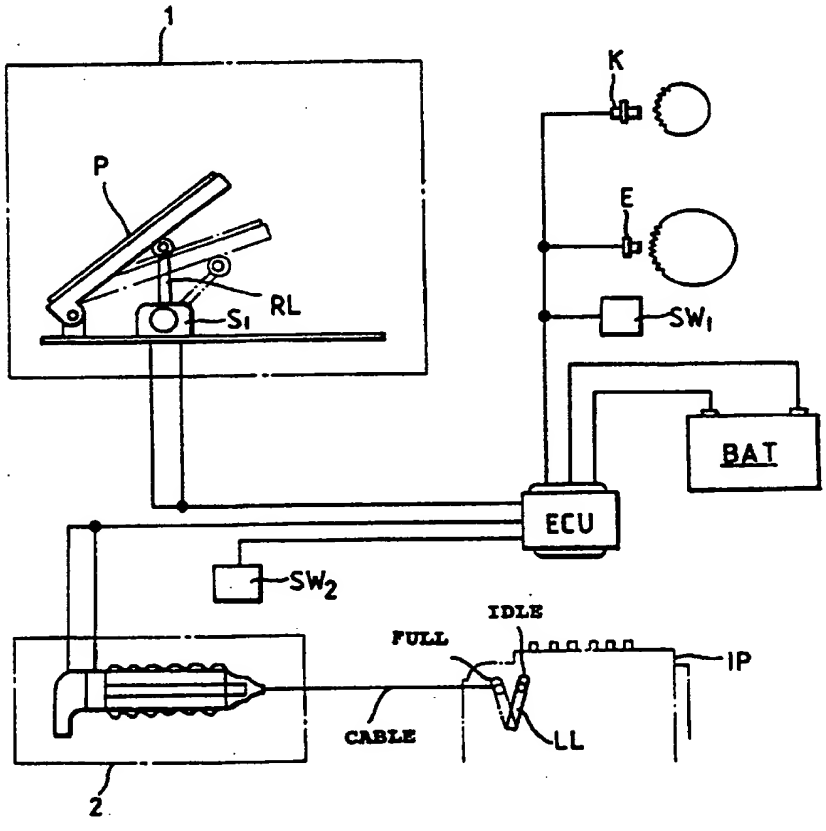
(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KE, KG, KZ, LK, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD).

Published
With international search report.

(54) Title: DEVICE FOR CONTROLLING ACCELERATOR PEDAL OF VEHICLE

(57) Abstract

An accelerator pedal control device for a vehicle including a pedal position sensor (S1) for sensing an actuated position of an accelerator pedal (P), a solenoid position sensor (S2) for sensing an actuated position of a solenoid device (2), an RPM sensor (K) for dectecting an engine RPM of the vehicle, a vehicle speed sensor (E) for detecting a speed of the vehicle, and an electronic control unit (ECU) for receiving output signals from the pedal position sensor (S1), the solenoid position sensor (S2), the RPM sensor (K) and the vehicle speed sensor (E), controlling an operating voltage to be applied to the solenoid device (2) and a duty ratio depending on the actuated position of the accelerator pedal (P) until the vehicle speed detected by the vehicle speed sensor (E)reaches a first predetermined vehicle speed, while comparing the received signals from the pedal position sensor (S1) and the solenoid position sensor (S2) with each other and increasing the duty ratio by a predetermined rate when the signal from the pedal position sensor (S1) has a higher value than the signal from the solenoid position sensor (S2).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

DEVICE FOR CONTROLLING ACCELERATOR PEDAL OF VEHICLE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an accelerator pedal control device applicable to vehicles such as large bus and truck.

Description of the Prior Art

Conventional accelerator pedal control devices are constructed to be operatively connected to an engine by means of a complex mechanical link mechanism. In other words, existing accelerator pedal control devices are of the linkage mechanism type, the air control type, or the motor-driven type. As a result, they can control only the actuation length of a rod lever for controlling a fuel injection pump. In actual, the actuation length is only about 10mm. Due to such a short actuation length, the conventional accelerator pedal control devices encounter various problems of an interference with various counterpart elements, an increase in response force, and a shortage in return force.

SUMMARY OF THE INVENTION

Therefore, an object of the invention is to provide an accelerator pedal control device for a vehicle capable of automatically controlling supplying of fuel depending on a response force of an accelerator pedal by the provision of an electronic control unit (ECU), a pedal position sensor attached to a conventional accelerator device, and a solenoid position sensor attached to a conventional solenoid

device, capable of achieving an automatic limitation of the maximum travel speed by the provision of a vehicle speed sensor, capable of achieving a constant speed control and an idle output control by the single ECU, and thereby capable of achieving an improvement in performance of the vehicle.

In accordance with the present invention, this object can be accomplished by providing a device for automatically controlling an accelerator pedal in a vehicle including an accelerator device having the accelerator pedal, a fuel injection pump having a fuel supply valve mechanism, and a solenoid device adapted to adjust the valve mechanism and thereby control supplying of a fuel, the device comprising: a pedal position sensor for sensing an actuated position of the accelerator pedal; a solenoid position sensor for sensing an actuated position of the solenoid device; an RPM sensor for detecting an engine RPM of the vehicle; a vehicle speed sensor for detecting a speed of the vehicle; and an electronic control unit for receiving output signals from the pedal position sensor, the solenoid position sensor, the RPM sensor and the vehicle speed sensor, controlling an operating voltage to be applied to the solenoid device and a duty ratio depending on the actuated position of the accelerator pedal until the vehicle speed detected by the vehicle speed sensor reaches a first predetermined vehicle speed, while comparing the received signals from the pedal position sensor and the solenoid position sensor with each other and increasing the duty ratio by a predetermined rate when the signal from the pedal position sensor has a higher value than the signal from the solenoid position sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and aspects of the invention will become apparent from the following description of embodiments with reference to the accompanying drawings in which:

FIG. 1 is a schematic view illustrating the overall construction of an accelerator pedal control device for a vehicle in accordance with the present invention;

FIG. 2 is a circuit diagram of the accelerator pedal control device shown in FIG. 1;

FIG. 3 is a circuit diagram of an A/D converter circuit constituting a part of the accelerator pedal control device shown in FIG. 1;

FIG. 4 is a sectional view of a solenoid device shown in FIG. 1;

FIG. 5 is a block diagram of the internal circuit arrangement of the accelerator pedal control device shown in FIG. 1;

FIG. 6 is a schematic view illustrating operation of an accelerator device associated with the accelerator pedal control device shown in FIG. 1; and

FIGS. 7A - 7D are flow charts illustrating control operation of an electronic control unit constituting a part of the accelerator pedal control device shown in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a schematic view illustrating the overall construction of an accelerator pedal control device for a vehicle in accordance with the present invention. As shown in FIG. 1, the accelerator pedal control device includes an ECU connected to an accelerator device 1. Connected to the ECU are an RPM sensor K adapted to detect RPM of an engine of the vehicle and a vehicle speed sensor E adapted to detect travel speed of the vehicle. A solenoid device 2 is also connected to the ECU. The solenoid device 2 is coupled to a rod lever LL connected to a fuel injection pump IP, by means of a cable. In FIG. 1, the reference character BAT represents a battery for the vehicle as a voltage supply source.

The accelerator device 1 includes a pedal P, a pedal position sensor S_1 such as a variable resistor VR_1, and a roller lever RL. The roller lever RL is connected to the pedal position sensor S_1 and disposed such that it is always in contact with the bottom surface of the pedal P and movable together with the pedal P. With such a construction, the pedal position sensor S_1 can detect the position of the pedal P being moved.

As shown in FIG. 2, the ECU comprises a microcomputer MICOM with a predetermined program. To the input of the microcomputer MICOM, the vehicle speed sensor E and the RPM sensor K are connected via an input processing circuit. The pedal position sensor S_1 detecting the moved position of the pedal P is also connected to the microcomputer MICOM via an analog/digital (A/D) converter circuit. In similar, a solenoid position sensor S_2 for detecting the moved position of the solenoid device 2 is also connected to the microcomputer MICOM via the A/D converter circuit. As shown in FIG. 5, the microcomputer MICOM is also coupled at its input with the input processing circuit for processing signals fed from a clutch and a brake device. The solenoid device 2 is coupled to the output of the microcomputer MICOM via an output processing circuit and a transistor TR1, as shown in FIG. 5. A voltage of 5V is supplied to the microcomputer MICOM and the circuit elements via a static voltage circuit REG_1, while a voltage of 20V is supplied to the solenoid device 2 via another static voltage circuit REG_2.

The pedal position sensor S_1 constituted by the variable resistor VR_1 is connected to an input stage AD_0 of the A/D converter circuit, as shown in FIG. 3. In similar, the solenoid position sensor S_2 constituted by the variable resistor VR_2 is connected to an input stage AD_1 of the A/D converter circuit.

In FIGS. 1 and 2, the reference characters SW_1 and SW_2

denote a constant-speed travel switch and an air conditioner switch, respectively.

Now, operation of the accelerator pedal control device having the above-mentioned arrangement in accordance with the present invention will be described, in conjunction with FIGS. 7A to 7D.

First, a function of automatically controlling the accelerator pedal will be described. For this function, an internal memory (ROM and RAM) and input/output elements of the microcomputer MICOM constituting the ECU are first initialized. As the accelerator pedal P is pressed down from its idle position IDLE to its full position FULL under the initialized condition, the roller lever RL being in contact with the bottom surface of the accelerator pedal P moves angularly while rolling along the bottom surface of the accelerator pedal P. By the angular movement of the roller lever RL, the variable resistor VR_1 serving as the pedal position sensor S_1 is varied in resistance. The varied resistance value of the variable resistor VR_1 is sent to the ECU. That is, the A/D converter circuit constituting a part of the ECU converts the resistance value into a corresponding voltage and then converts the voltage into a corresponding 8-bit digital value (1 to 256 steps). This digital value is sent to an operating circuit of the microcomputer MICOM so as to discriminate the position of the accelerated pedal P (the A/D converter circuit receives a "conversion initiation value" signal from the microcomputer MICOM, converts an analog value received to its corresponding input stage and transmits a "conversion completion" signal to the microcomputer MICOM).

The microcomputer MICOM controls its output voltage to be applied to the solenoid device 2 and a duty ratio, depending on the digital value (1 to 256 steps) and outputs the resultant signal via its output processing circuit. The output signal from the microcomputer MICOM is received to

the transistor TR_1 which is, in turn, activated. At the activated state of the transistor TR_1, the voltage of 20V is applied to the solenoid device 2 via the static voltage circuit REG_2, thereby causing the solenoid device 2 to be activated.

When the solenoid device 2 is activated, the cable connected between the solenoid device 2 and the rod lever LL of the fuel injection pump IP is pulled by the solenoid device 2 such that the rod lever LL is moved from its idle position IDLE to its full position FULL. At the full position FULL of the rod lever LL, the fuel injection pump P is largely opened, thereby increasing the amount of oil supplied to the engine.

During the above-mentioned operation, the microcomputer MICOM compares continuously the position of the accelerator pedal P and the position of the solenoid device 2 with each other. When the value indicative of the pedal position is higher than the value indicative of the solenoid position, the microcomputer MICOM calculates a vehicle speed signal received from the vehicle speed sensor E. If the calculated vehicle speed is not more than a predetermined reference value, for example, 100Km/h, the microcomputer MICOM then increases the duty ratio by a predetermined percent (Y%). As a result, the opened degree of the fuel injection pump is accurately controlled depending on the pressed degree of the accelerator pedal achieved by a driver. Accordingly, it is possible to achieve an improvement in fuel consumption efficiency.

Second, a function of limiting the maximum vehicle speed will be described. This function is adapted to prevent the vehicle speed from being increased over a predetermined vehicle speed (that is, the normally limited vehicle speed of 100Km/h in the case of bus and 85Km/h in the case of truck) during the driving of the vehicle even when the driver further presses down the accelerator pedal

P. For this function, the microcomputer MICOM compares the vehicle speed with a predetermined maximum vehicle speed value (for example, a frequency of 1061.7Hz corresponding to 100Km/h) stored therein. When the vehicle speed reaches the predetermined maximum vehicle speed, the microcomputer MICOM controls the output voltage to be applied to the solenoid device 2 and the duty ratio no longer even when the accelerator pedal P is further pressed down. As a result, the vehicle can be safely driven within the predetermined maximum limited speed.

Third, a function of controlling the vehicle at a constant speed, namely, an operation in a constant-speed travel mode will be described. When the driver switches on the constant-speed travel switch SW_1 for the operation in the constant-speed travel mode, the ECU serves to keep the vehicle speed set by the driver constant, thereby enabling the vehicle to be driven at a constant speed.

That is, a vehicle speed signal from the vehicle speed sensor E is continuously sent to the ECU. The microcomputer MICOM of the ECU compares the current vehicle speed based on the received speed signal with the vehicle speed (for example, 90Km/h) set by the driver. When the current vehicle speed is less than the set vehicle speed, the microcomputer MICOM increases the output voltage to be applied to the solenoid device 2 and the duty ratio. On the other hand, the microcomputer MICOM decreases the output and the duty ratio when the current vehicle speed is not less than the set vehicle speed. This operation in the constant-speed travel mode is released immediately when the driver presses down a brake pedal or a clutch pedal. That is, when the driver presses down the brake pedal or the clutch pedal, the microcomputer MICOM receives a signal indicative of the press-down of the brake pedal or the clutch pedal via the input processing circuit and then releases the constant-speed travel mode immediately. Simultaneously, the

microcomputer MICOM performs a control for maintaining the engine at its idle state.

Fourth, a function of increasing an engine output at the idle state will be described. When the driver switches on the air conditioner switch SW_2, the ECU controls the fuel injection pump IP to increase the engine output at the idle state, namely, to generate the engine output meeting the operation load of the air conditioner. For example, where the air conditioner is operated during the stoppage of the vehicle in summer, the ECU compares a signal indicative of RPM of the engine and sent from the RPM sensor K with an RPM of the engine required for the operation of the air conditioner. When the current engine RPM is less than the required engine RPM, the ECU increases the output voltage to be sent to the solenoid device 2 and the duty ratio. On the other hand, the ECU decreases the output voltage and the duty ratio when the current engine RPM is not less than the required engine RPM. Thus, it is possible to generate an engine output meeting the load by controlling the solenoid device 2.

As apparent from the above description, the present invention provides an accelerator pedal control device for a vehicle including an ECU constituted by a microcomputer performing a control operation capable of achieving an accurate co-operation between an accelerator pedal and a fuel injection pump, thereby achieving an improvement in fuel consumption efficiency. The accelerator pedal control device can also achieve an automatic control for the maximum speed of speed-limited vehicles such as bus and truck. This accomplishes a safe travel of vehicles. In accordance with the present invention, it is also possible to achieve a control for a vehicle travel at a constant-speed. This provides a convenience in driving of vehicles. Since the accelerator pedal control device of the present invention enables the engine output to be automatically increased to

a value meeting an engine load at an idle state. As a result, there is an effect of a lengthened engine life.

Although the preferred embodiments of the invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

WHAT IS CLAIMED IS:

1. A device for automatically controlling an accelerator pedal in a vehicle including an accelerator device having the accelerator pedal, a fuel injection pump having a fuel supply valve mechanism, and a solenoid device adapted to adjust the valve mechanism and thereby control supplying of a fuel, the device comprising:

a pedal position sensor for sensing an actuated position of the accelerator pedal;

a solenoid position sensor for sensing an actuated position of the solenoid device;

an RPM sensor for detecting an engine RPM of the vehicle;

a vehicle speed sensor for detecting a speed of the vehicle; and

an electronic control unit for receiving output signals from the pedal position sensor, the solenoid position sensor, the RPM sensor and the vehicle speed sensor, controlling an operating voltage to be applied to the solenoid device and a duty ratio depending on the actuated position of the accelerator pedal until the vehicle speed detected by the vehicle speed sensor reaches a first predetermined vehicle speed, while comparing the received signals from the pedal position sensor and the solenoid position sensor with each other and increasing the duty ratio by a predetermined rate when the signal from the pedal position sensor has a higher value than the signal from the solenoid position sensor.

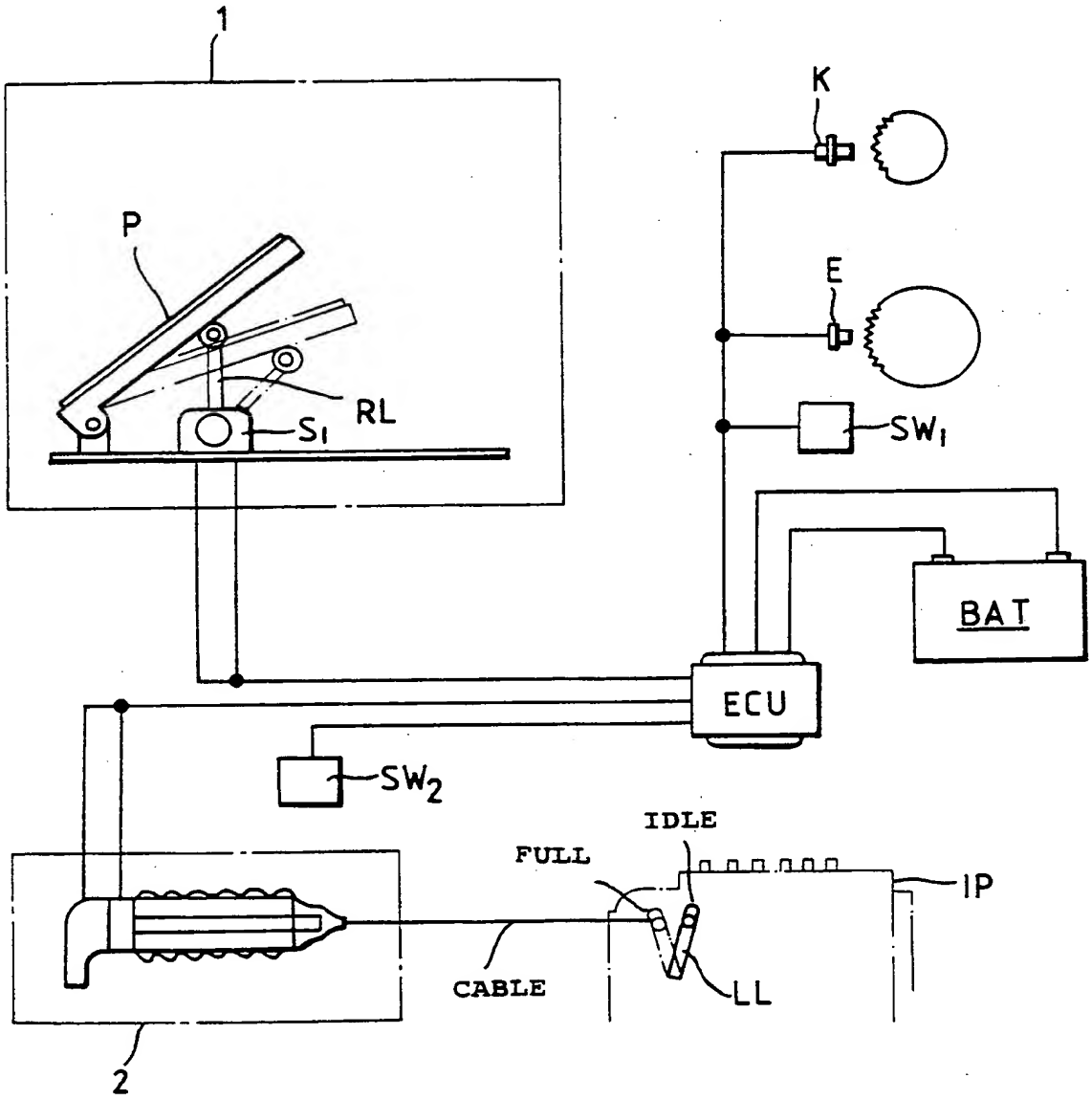
2. An accelerator pedal control device in accordance with claim 1, wherein the pedal position sensor comprises a variable resistor.

3. An accelerator pedal control device in accordance with claim 1, wherein the electronic control unit controls the operating voltage and the duty ratio to be constant irrespective of the actuated position of the accelerator pedal when the detected vehicle speed is not less than the first predetermined vehicle speed.

4. An accelerator pedal control device in accordance with claim 1, wherein the electronic control unit compares the detected vehicle speed with a second predetermined vehicle speed lower than the first predetermined vehicle speed in a constant-speed travel mode, and controlling the operating voltage and the duty ratio depending on the result of the comparison to automatically execute an operation in the constant-speed travel mode.

5. An accelerator pedal control device in accordance with claim 1, wherein the electronic control unit compares the detected engine RPM with a predetermined engine RPM when an operation in an air conditioner operation mode is initiated at an engine idle state, and controlling the operating voltage and the duty ratio depending on the result of the comparison to automatically increase an engine output at the engine idle state in accordance with an increase in load.

FIG. 1



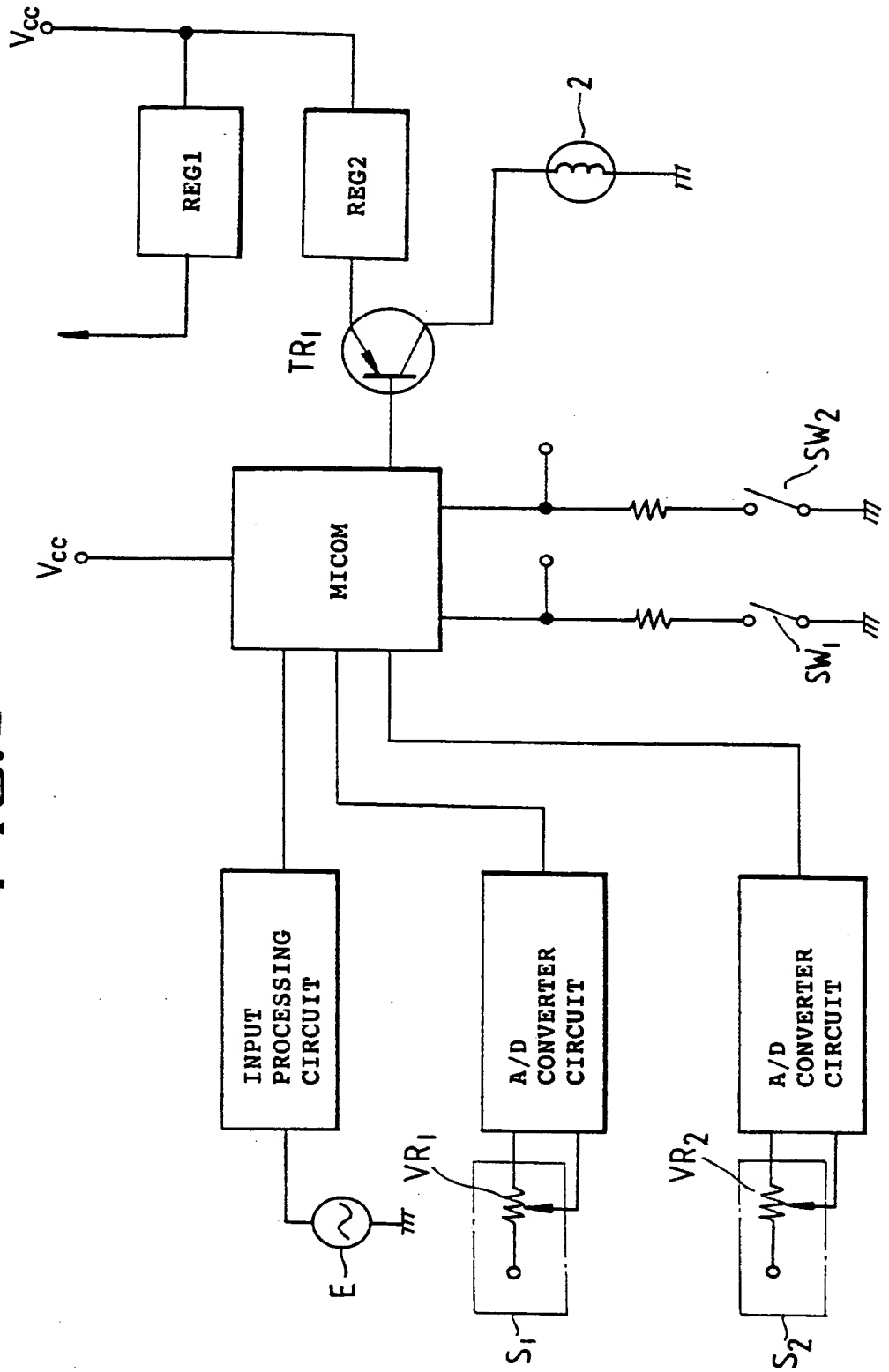

Vcc
REG1
REG2
2
TR1
MICOM
Vcc
SW2
SW1
INPUT PROCESSING CIRCUIT
A/D CONVERTER CIRCUIT
A/D CONVERTER CIRCUIT
VR1
VR2
E
S1
S2

FIG.2

FIG. 3

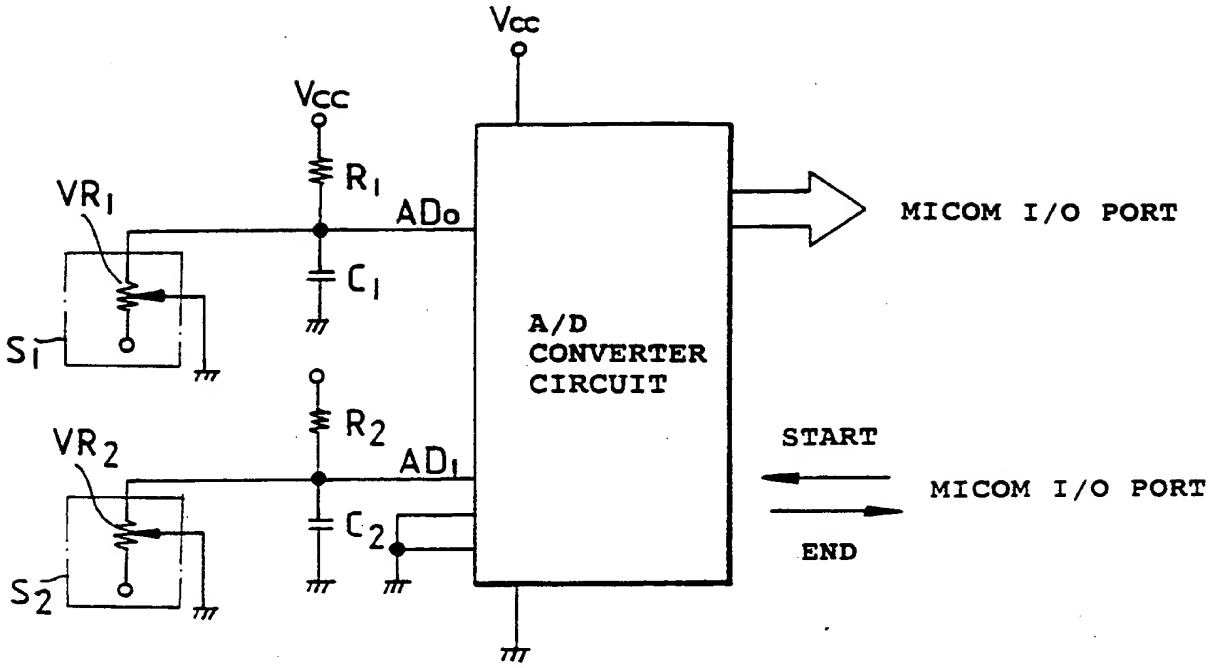


FIG. 4

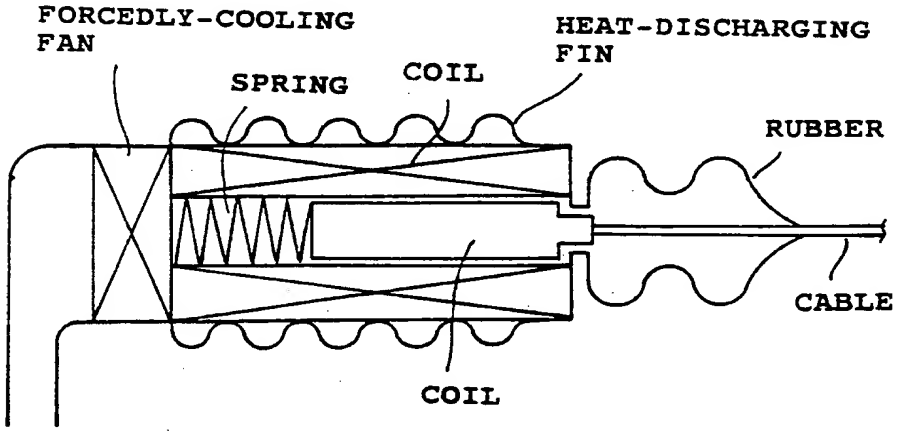


FIG. 5

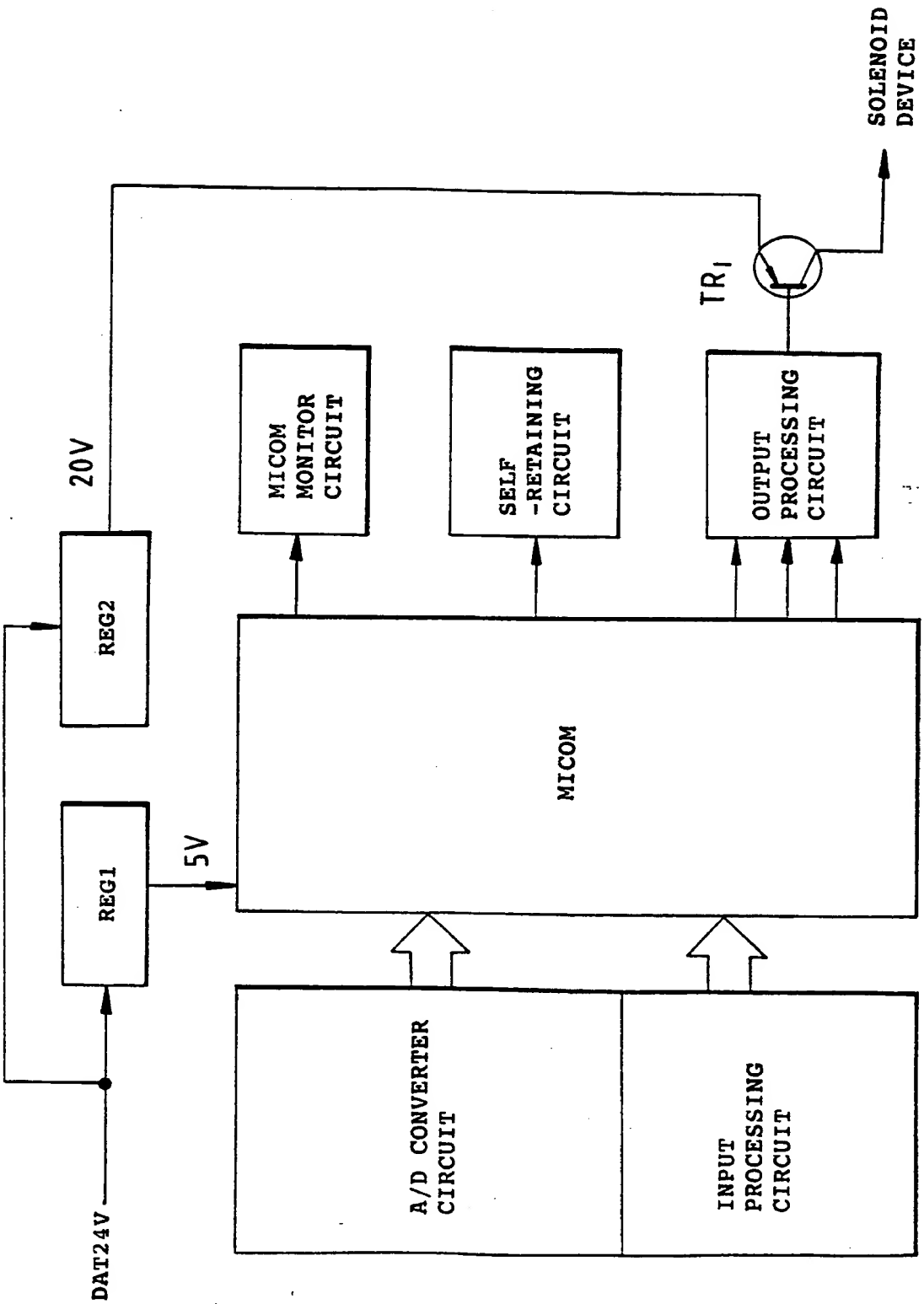


FIG. 6

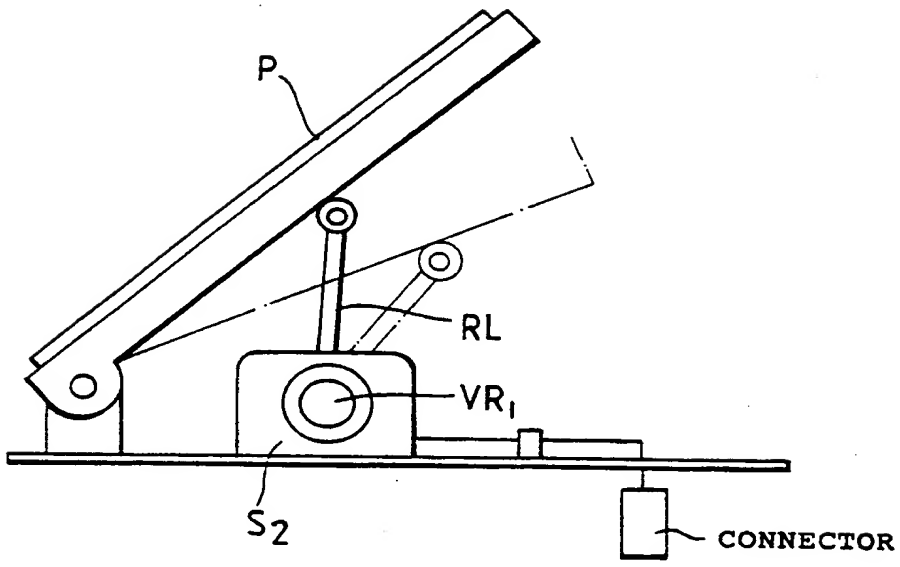
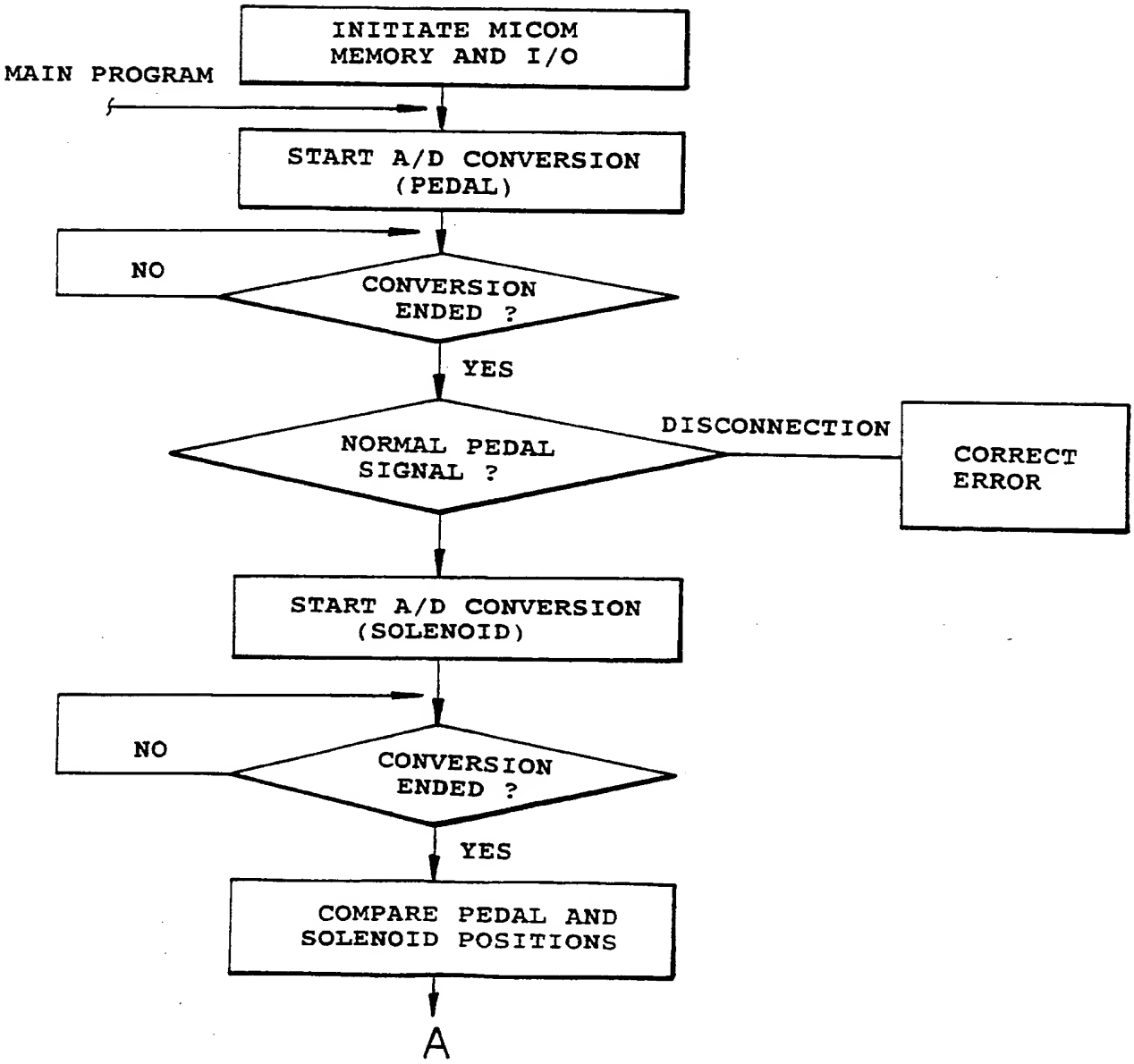


FIG.7 (A)



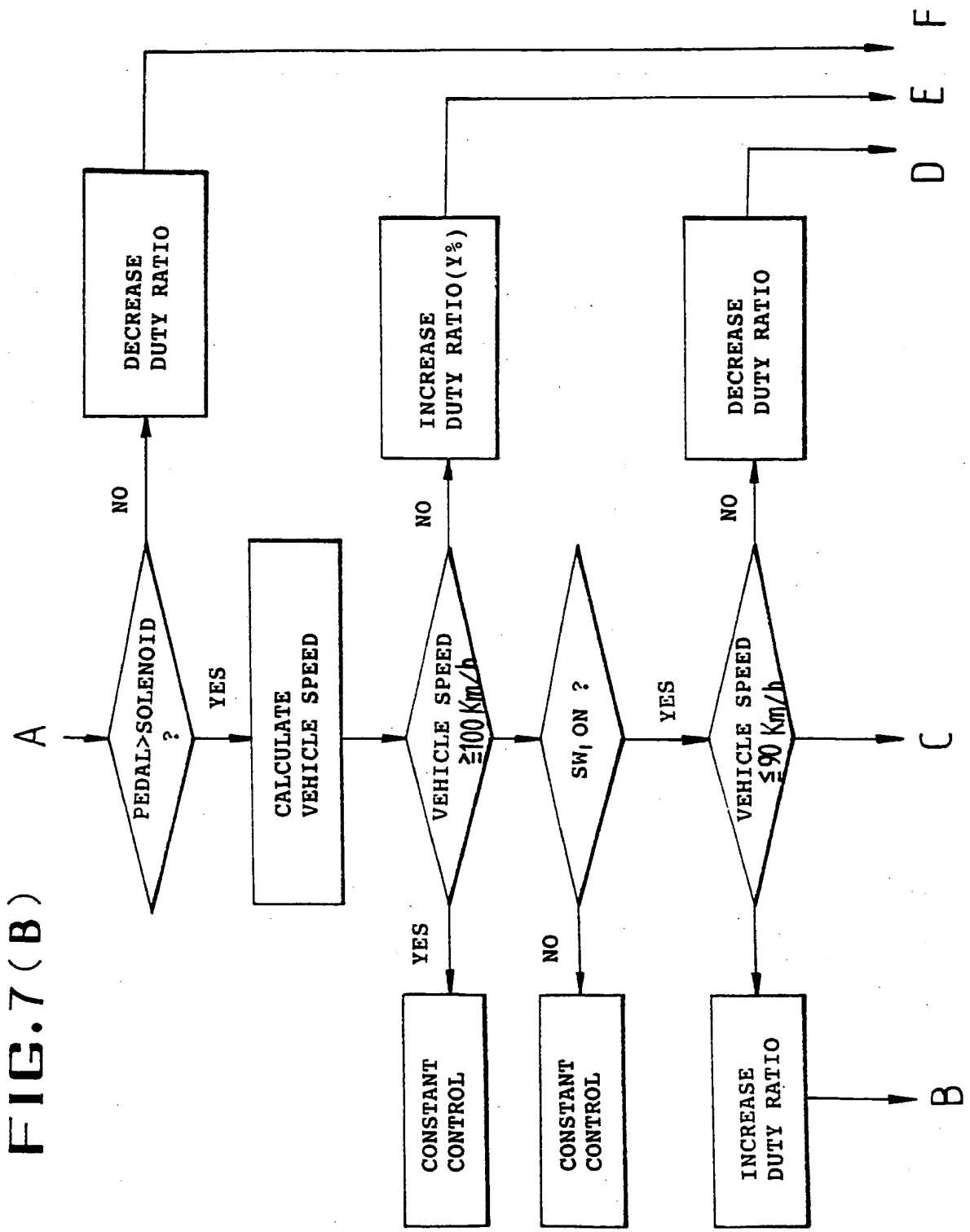


FIG.7(B)

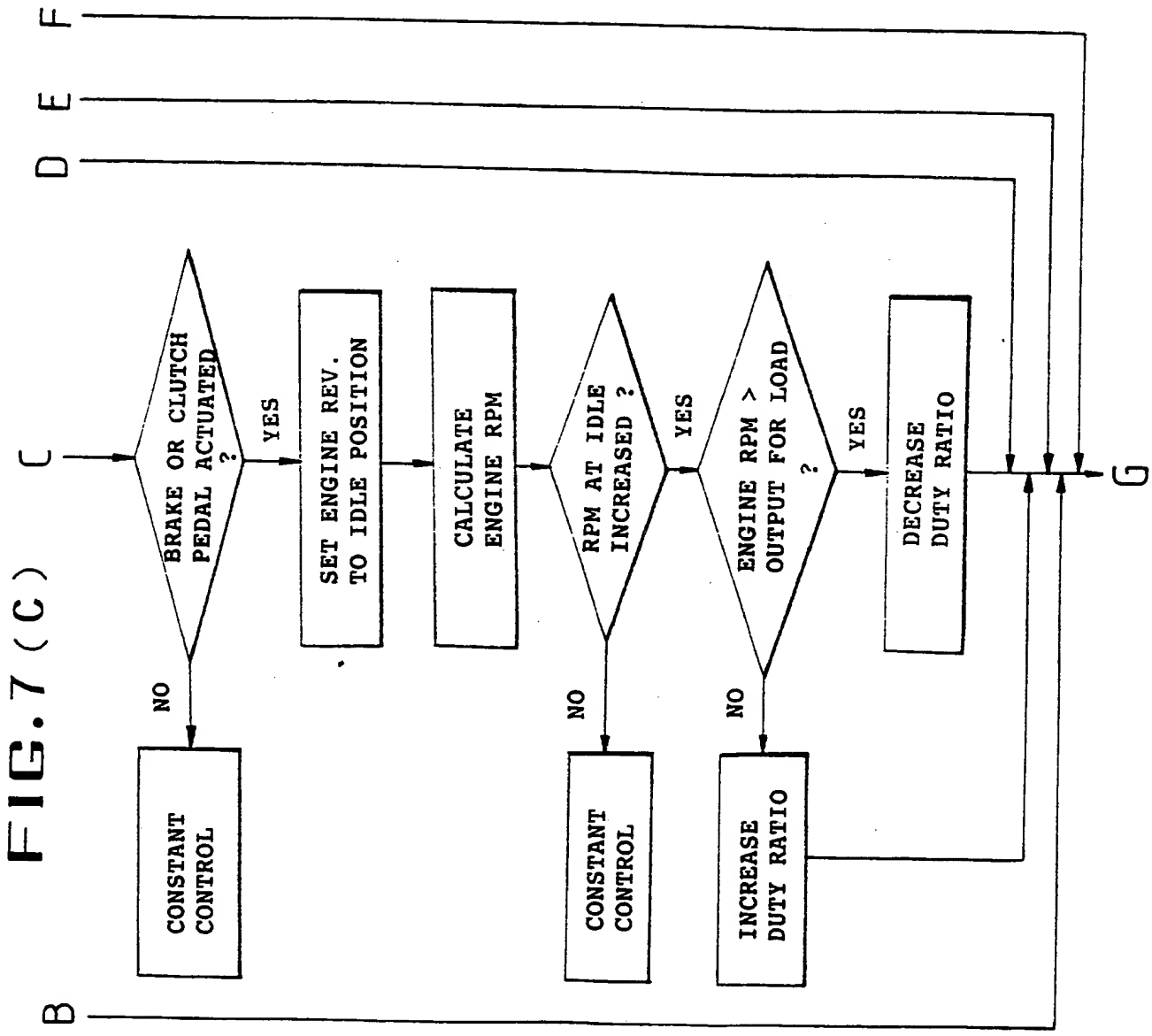
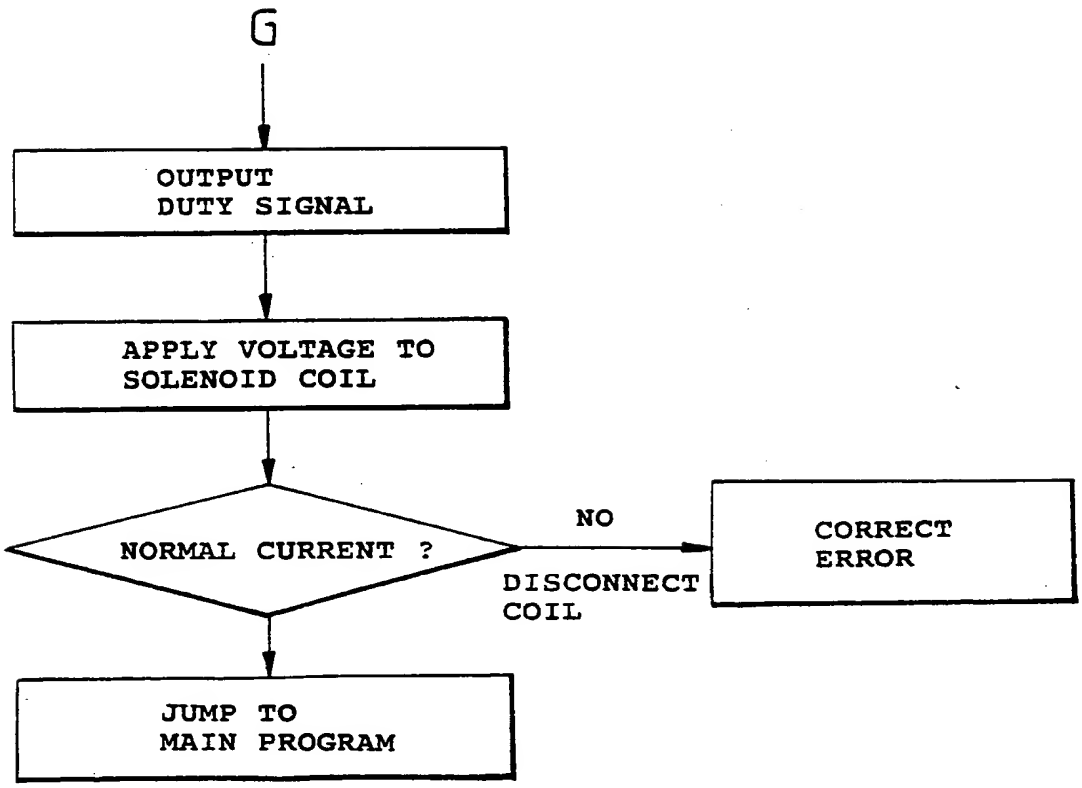


FIG. 7 (C)

FIG. 7 (D)



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 94/00112

A. CLASSIFICATION OF SUBJECT MATTER

IPC[6]: G 05 D 13/62

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[6]: G 05 D 13/00; F 02 D 31/00; B 60 K 31/00, 41/00; F 02 D 11/00; G 05 D 17/00; F 02 P 19/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 03 33 702 A2 (VOEST-ALPINE) 20 September 1989 (20.09.89), abstract; page 2, lines 44-55; claims;fig.1.	1 3-5
Y A	US 50 86 740 A (WIGGINS) 11 February 1992 (11.02.92), fig., abstract, claims.	3-5 1
Y A	DE 40 29 976 A1 (NISSAN) 04 April 1991 (04.04.91), fig.; column 2, line 59 - column 4, line 40; claims; fig., abstract, claims.	3-5 1
Y A	EP 01 89 190 A2 (MAZDA) 30 July 1986 (30.06.86), fig.; abstract; page 6, line 27 - page 8, line 14; fig., abstract, claims.	3-5 1
A	EP 05 65 431A(RENAULT) 13 October 1993 (13.10.93), fig. 1; abstract; column 7, lines 2-5.	1,2
A	US 49 28 227A(BURBA) 22 May 1990 (22.05.90), fig. 5; abstract.	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 January 1995 (31.01.95)	09 March 1995 (09.03.95)

Name and mailing address of the ISA/ AT	Authorized officer
AUSTRIAN PATENT OFFICE Kohlmarkt 8-10 A-1014 Vienna	Kral e.h.
Facsimile No. 1/53424/535	Telephone No. 1/53424/335

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR 94/00112

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
EP A2 333702	20-09-89	AT E 100901	15-02-94
		DE A1 3808820	28-09-89
		DE C2 3808820	06-06-91
		DE C0 58906795	10-03-94
		EP A3 333702	11-04-90
		EP B1 333702	26-01-94
		ES T3 2049847	01-05-94
US A 5086740	11-02-92	EP A1 554288	11-08-93
		WO A1 9207729	14-05-92
DE A 4029976		DE A1 4029976	04-04-91
		DE C2 4029976	28-10-93
		JP A2 3107670	08-05-91
EP A2 189190	30-07-86	DE C0 3670342	17-05-90
		EP A3 189190	09-12-87
		EP B1 189190	11-04-90
		JP A2 61171843	02-08-86
		JP B4 3063655	02-10-91
		US A 4691677	08-09-87
EP A1 565431	13-10-93	FR A1 2689569	08-10-93
US A 4928227	22-05-90	keine - none - rien	

Form PCT/ISA/210 (patent family annex) (July 1992)